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NEW SICYDIINE GOBIES FROM PONAPE AND PALAU, MICRONESIA, WITH COMMENTS ON SYSTEMATICS OF THE SUBFAMILY SICYDIINAE (TELEOSTEI: GOBIIDAE)

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ABSTRACT

Five species of the rock-climbing, gobiid subfamily Sicydiinae are now known from Ponape, Eastern Caroline Islands, Micronesia, four of which are described herein as new: *Sicyopus nigriradiatus, Sicyopterus lividus, Sicyopterus eudentatus,* and *Stiphodon caeruleus.* This increases the number of described freshwater/estuarine fish species from that volcanic island to 15. The fifth sicydiine species from Ponape, *Stiphodon* cf. *elegans,* is compared with other Pacific basin *Stiphodon. Sicyopus fehlmanni* is described as new from Babelthuap and Koror islands, Palau, Western Caroline Islands, Micronesia. Sicydiinae Bleeker, 1874, is the valid name for this subfamily. The widely used name Sicydiaphiinae Koumans, 1931, is an improperly formed synonym of Sicydiinae. A newly described character to support sicydiine monophyly involves relative position of the pelvic-fin spine and rays. A key to Ponapean sicydiines is provided.

Gobioid fishes are common in streams of tropical and subtropical oceanic islands. Of 15 native freshwater/estuarine fish species known from Ponape, 10 are gobioids. Of these, five species in three genera (Maciolek and Ford, 1987) are in the gobiid subfamily Sicydiinae, commonly known as rock-climbing or toothed-lip gobies (Table 1).

Island-group endemism is high among the approximately 95 nominal sicydiine species, particularly in the Indo-Pacific (D. F. Hoese, pers. comm.). More new species remain to be described (Randall et al., 1990; Ryan, 1991). Our objectives herein are to describe five new species from the Caroline Islands, add support to the hypothesis of monophyly of the subfamily Sicydiinae, and demonstrate that Sicydiinae is the valid name for this gobiid subfamily.

Ponape (Pohnpei) is a volcanic island in the western Pacific at approximately 6°50′N, 158°10′E. Politically, it is part of the Federated States of Micronesia; geographically, it is part of the Eastern Caroline Islands. Ponape is approximately 334 km^2 in area, and has more than 40 radially arranged, perennial streams (Maciolek and Ford, 1987). Adult and subadult specimens of five sicydiine species, four undescribed, were collected in fast-flowing, rocky-bottom streams including the Nanpil-Kiepw, Meitik, Soundah, Ninduwi, Nanqui (Nankewi) and Pilen Salapwuk-Lehn Mesi stream systems (Fig. 1). A key to Ponapean sicydiines follows the species descriptions.

A fifth new species is described from Babelthuap and Koror, two volcanic or volcanic/limestone islands in the Palau Archipelago at approximately 7°23′N, 134°33′E (Bayer and Harry-Rofen, 1957; Fig. 2). These two islands are politically part of independent Palau (Belau), western Caroline Islands, Micronesia. Babelthuap, with an area of approximately 396 km^2, is the largest volcanic island in the Carolines (Birkeland et al., 1976). Adult and subadult specimens of a new sicydiine species were collected from Tengyoi stream, Koror, and the Amekaud, Ngeremeskang, Iklong, Imengelngal, and Arakitaoch drainages, Babelthuap, by "Project Coral Fish" of the George Vanderbilt Foundation (Fig. 2; see Bayer and Harry-Rofen, 1957).

Table 1. Genera included in selected sicydiine family-group classifications

Bleeker (1874) Sicydiini	Koumans (1931) Sicydiaphiinae	Present study Sicydiinae
Tridentiger Gill, 1859	*Pleurosicya* Weber, 1913	*Sicyopus*
Sicydium Valenciennes, in Cuvier and Valenciennes, 1837	*Gobiopterus* Bleeker, 1874	*Lentipes*
Sicyopterus Gill, 1860	*Leptogobius* Bleeker, 1874	*Sicydium* (*Parasicydium* tentatively considered a synonym)
subgenus *Sicyopterus*	*Cotylopus*	*Sicyopterus*
subgenus *Cotylopus* Guichenot, 1864	*Evorthodus* Gill, 1859	*Stiphodon*
subgenus *Sicydiops* Bleeker, 1874	*Aphia* Risso, 1826	
Microsicydium Bleeker 1874	*Sicyopus* Gill, 1863	
Lentipes Günther, 1861	*Lentipes*	
	Sicydium	
	Sicyopterus	
	Stiphodon Weber, 1895	

Materials and Methods

Sicydiine material was collected at Ponape between 1971 and 1986. Most specimens were collected and preserved as detailed in Maciolek and Ford (1987), donated to the Department of Ichthyology, California Academy of Sciences (CAS), San Francisco, transferred to 75% ethanol, and catalogued. Two additional lots of *Stiphodon* collected by V. G. Springer and party are at the National Museum of Natural History (USNM), Washington, D.C.

Specimens were collected at 11 field stations on Babelthuap and Koror islands during the 1955–1957 George Vanderbilt Foundation expeditions to the Palau Islands and deposited in the Stanford University fish collection, now at CAS and bearing catalog numbers with the prefix CAS-SU. This material was fixed in formalin and maintained in 50% isopropanol.

Some type material was transferred to the Bernice P. Bishop Museum (BPBM), the Royal Ontario Museum (ROM), and the USNM. Institutional abbreviations follow the Standard Symbolic Codes for Institutional Research Collections in Herpetology and Ichthyology (Leviton et al., 1985).

Representative specimens were cleared and either counterstained with alcian blue and alizarin red (Dingerkus and Uhler, 1977), or stained solely with alizarin. Generic citations follow Eschmeyer (1990) and Ryan (1986). Species diagnoses include only those characters unique or otherwise hypothesized to be autapomorphic (sensu Hennig, 1966). Additional characters useful for identification are given in descriptions, comparisons, and the key.

Premaxillary and dentary bones, examined using the Hitachi S520 Scanning Electron Microscope at CAS, were dissected from cleared and counterstained specimens, two-stage dehydrated in 95% and absolute ethanol, mounted on stubs, and air-dried prior to platinum/gold coating. Description of live color is from photographs and manuscript notes of live or freshly killed specimens. Preserved color is that after fixation in formalin and storage in alcohol.

Counts were made from radiographs, scanning electron micrographs, and cleared and stained or alcohol specimens. Lateral scale rows are those along the mid-side of the body from just posterior to the dorsal extent of the gill opening to the point of caudal flexure. Scale counts are highly variable within and among species because of irregular scale placement; reported values are approximate.

Measurements are straight-line distances recorded with metric dial calipers and are reported as a range of percents of standard length (SL). Values for the holotype are given in brackets following counts or measurement ranges.

Below, we diagnose sicydiines as monophyletic using the gobiines sensu Hoese (1984) (*Awaous, Stenogobius, Rhinogobius* Gill, 1859, and *Evorthodus*), an oxudercine (*Periophthalmus* Bloch and Schneider, 1801), an eleotridid (*Hypseleotris* Gill, 1863), and Rhyacichthyidae (*Rhyacichthys* Boulenger, 1901), sister group of all other gobioids, for outgroup comparison (Miller, 1973; Springer, 1983; Hoese, 1984; Birdsong et al., 1988; Harrison, 1989; Pezold, 1993). *Pleurosicya* and allied genera are not close sicydiine relatives; we include them in outgroup comparisons because their pelvic-fin specializations ". . . somewhat resemble . . ." (Larson, 1990: 48) those of sicydiines.

Specimens of the five Ponapean and one Palauan species are listed under each species account. Additional material examined follows:

Sicydiine Material.—*Sicyopus leprurus,* Marianas Is., CAS 67560, 1 spec. cleared and counterstained. *Lentipes concolor,* Hawaiian Is.: Maui, USNM 316119, 12 spec., including 3 cleared and counter-

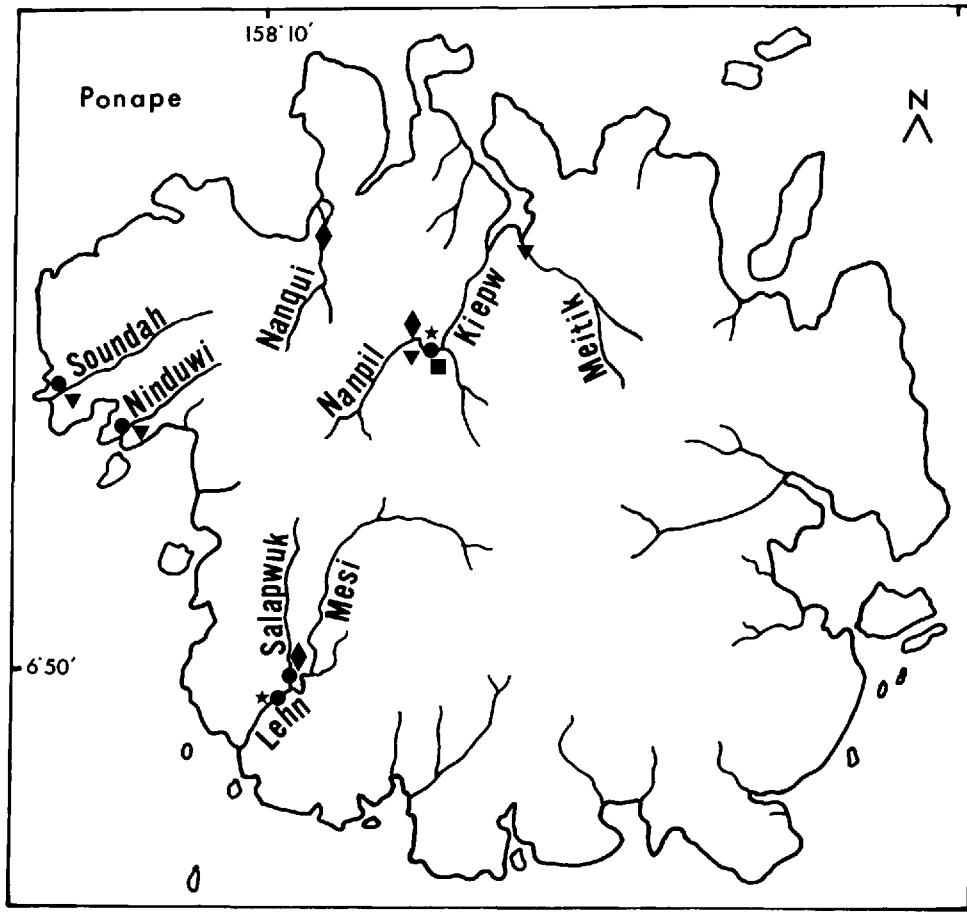

Figure 1. Outline map of Ponape (Pohnpei), E. Caroline Is., with stream drainages where specimens were collected. Each symbol may represent more than one collection. Circles, *Sicyopus nigriradiatus*; stars, *Sicyopterus lividus*; square, *Sicyopterus eudentatus*, triangles, *Stiphodon caeruleus*; and diamonds, *Stiphodon* cf. *elegans*.

stained. *Sicydium punctatum*, Virgin Is., USNM 122450, 1 spec. cleared and counterstained. *Parasicydium bandama*, Cameroon, BMNH 1989.1.6:36, 1 spec. *Sicyopterus crassus*, Philippines, CAS-SU 38603, 6 spec. *Sicyopterus extraneus*, Philippines, CAS-SU 38607, 695 spec., including 5 cleared and counterstained. *Sicyopterus longifilis*, Papua New Guinea, CAS 63389, 160 spec., including 2 cleared and counterstained. *Sicyopterus pugnans*, Samoa, CAS 67469, male, 33.2 mm SL, female, 34.7 mm SL, cleared and stained solely with alizarin; CAS 67542, 5 spec. *Stiphodon semoni*, Papua New Guinea, CAS 63387, 109 spec., including 2 cleared and counterstained. *Stiphodon stevensoni*, Samoa, Tutuila Is., CAS 67524, 1 male.

Comparative Material.—*Awaous* sp., Philippines, USNM 287150, 1 spec. cleared and counterstained. *Awaous stamineus*, Hawaiian Is.: Maui, USNM 316042, 6 spec. *Awaous tajasica*, USNM 213491, 2 spec. cleared and stained solely with alizarin. *Evorthodus lyricus*, Texas, USNM 287149, 2 spec. cleared and stained solely with alizarin; Virgin Is., USNM 106630, 5 spec. *Hypseleotris* sp., Australia: Queensland, AMS uncat., 10 spec. cleared and counterstained. *Periophthalmus argentilineatus*, Philippines, USNM 278285, 3 spec. cleared and counterstained. *Pleurosicya labiatus*, Indonesia: Moluccas, USNM 209995, 4 spec.; Seribu Is., USNM 315586, 1 spec. *Rhinogobius brunneus*, Japan: Iriomote Is., AMS I.31524-001, 2 spec. cleared and counterstained. *Rhinogobius mekongianus*, Thailand: Chiang Mai Prov., AMS I.25973-001, 1 spec. cleared and counterstained. *Rhyacichthys aspro*, Sulawesi, AMNH

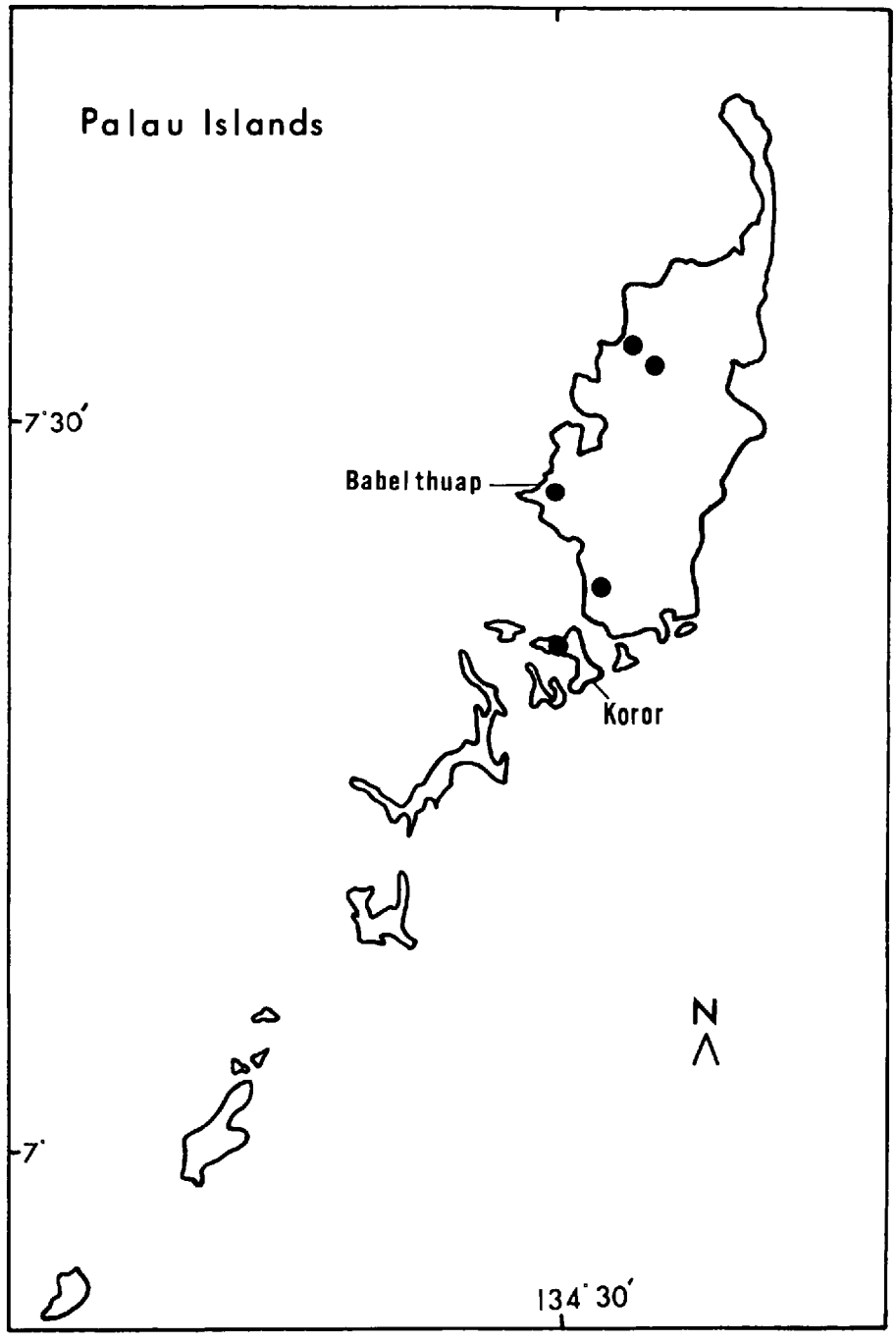

Figure 2. Outline map of Palau, W. Caroline Is., with localities where specimens of *Sicyopus fehlmanni* were collected on Babelthuap and Koror islands. Each circle may represent more than one collection.

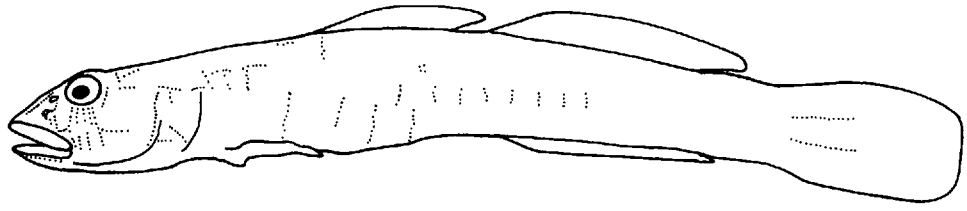

Figure 3. Diagrammatic lateral view of a sicydiine to illustrate superficial neuromast patterns, in part from notes of H. A. Fehlmann. Sensory-pore pattern and pectoral fin not shown.

48695SW, 1 spec. cleared and counterstained. *Stenogobius laterisquamatus*, Papua New Guinea, CAS 63702, 156 spec., including 4 cleared and counterstained.

Synapomorphies of Gobiid Subfamily Sicydiinae

Synapomorphies of sicydiines include specializations of pelvic fins, jaws and jaw suspensorium, and soft anatomy that are correlated with rock-climbing ability (Hoese, 1984: 590): "Tongue fused to floor of mouth or free only at tip, highly modified jaw suspension; thickened and highly branched pelvic rays and fleshy pads at tips of pelvic spines." Harrison (1989: fig. 11) supported sicydiine monophyly with the last three of these characters and added a fourth, dorsal expansion of the premaxilla, but examined only the three most derived sicydiine genera (*Stiphodon, Sicyopterus,* and *Sicydium*). Parenti (1991: fig. 9) used a subset of Hoese's (1984) characters to support a monophyletic Sicydiinae.

We follow Birdsong et al. (1988) and Harrison (1989) for hypotheses of close sicydiine relatives. Birdsong et al. (1988: table 28) reported a 3-12210 dorsal pterygiophore formula for their informal "*Sicydium* group" comprising sicydiines, *Awaous,* and *Evorthodus.* We have confirmed this formula in Ponape and Palau sicydiines. Harrison (1989: fig. 11) used the 3-12210 formula and a long palatine bone as two putative synapomorphies of a lineage comprising sicydiines, *Awaous,* and gobionellines. In Harrison's (1989) scheme, *Evorthodus* is a gobiine and *Stenogobius* is a plesiomorphic gobionelline. Harrison (1989: fig. 11) postulated further that *Awaous* and sicydiines are sister taxa that share one epural bone in the caudal skeleton and proliferation of row "a" suborbital superficial neuromasts into disjunct vertical rows.

Patterns of lateralis-system pores and superficial neuromasts have been used extensively to distinguish among gobioid taxa (Sanzo, 1911; Hoese, 1983, 1984; Akihito, 1986; Wongrat and Miller, 1991). Because they are complex and variable, often poorly preserved or weakly developed, superficial neuromast (sometimes "papilla" or "pit organ") patterns within and among species are difficult to recognize and describe accurately. General characteristics of the sicydiine superficial neuromast system are illustrated in Figure 3. Sicydiines have a so-called transverse pattern in which cheek and preopercular neuromasts are arranged in two horizontal and four or more vertical rows (Hoese, 1983). A prominent preorbital row extends anteriorly nearly to the snout tip. Opercular neuromasts are distributed in a combination of horizontal and vertical rows. Body neuromasts occur in several dorsal and ventral vertical rows and a series of about eight median vertical rows that end at a perpendicular through the second dorsal fin. There are at least two rows of superficial neuromasts visible on the caudal fin, one row along upper rays and one along lower rays.

Precise comparisons of these neuromast patterns among taxa require support for pattern homology. For example, in eleotridids, vertical rows of suborbital superficial neuromasts are innervated by different branches of the ramus buccalis branch of the truncus infraorbitalis, associated with the trigeminal cranial nerve (Wongrat and Miller, 1991: figs. 1 and 3). Are vertical rows of superficial neuromasts ventral to the eye homologous in eleotridids and other gobioids such as *Awaous,* sicydiines, *Stenogobius,* and *Rhinogobius* (Akihito et al., 1984)? The question cannot be answered satisfactorily without additional support for homology of neuromast patterns from other characters, such as neuromast innervation patterns (Wongrat and Miller, 1991; J. Song, pers. comm.).

Variation of some sensory-canal pore characters among sicydiine genera is summarized in Table 2 (see also Sakai and Nakamura, 1979: table 2; Pezold, 1993). Additional diagnostic characters of sicydiines might be recognized among sensory canal patterns were polarity and homology assessment not ambiguous. There are two preopercular-canal pores (identified as pores M′ and O′, following Akihito, 1986) in *Sicyopus, Lentipes, Stiphodon,* and some species of *Sicydium,* and three pores (M′, N, and O′) in other species of *Sicydium* and in *Sicyopterus. Stenogobius genivitattus* (Akihito et al., 1984: fig. 156) and *Awaous ocellaris* (Akihito et al., 1984: fig. 131) have three preopercular-canal pores, M′, N, and O′. Inferred reduction to two pores is interpreted as loss of the middle (N) pore. Distribution of this character (two preopercular pores) is in conflict with characters 1, 2, 4, 5, 6, and 8 in Table 2. Two preopercular pores could be interpreted as diagnostic of sicydiines, with a reversal to the inferred plesiomorphic condition in some *Sicydium* species and in *Sicyopterus.*

The oculoscapular-canal of *Sicyopus* has pores A′, B, C, D (single), F, H′, K′ and L′ (Akihito et al., 1984: figs. 211–212). The fleshy portion of the canal is not continuous between pores H′ and K′. The same pattern is found in *Stenogobius genivitattus* (Akihito et al., 1984: fig. 156), *Evorthodus, Gnatholepis, Oligolepis, Lentipes,* and *Stiphodon* (Pezold, 1993), and might be plesiomorphic for sicydiines. *Sicydium* and *Sicyopterus* have a unique oculoscapular-canal pore pattern of A′, B, C, D (single), F, HK, and L′ (Pezold, 1993). The canal is continuous between pores F and L′; there is a single pore (HK) presumably formed from fusion of pores H′ and K′ (Akihito, 1986: fig. 3).

Polarity of the oculoscapular-canal pore pattern is clear when using *Stenogobius* as an outgroup, as above, but ambiguous when using *Awaous* as an outgroup. Some *Awaous* species have a pattern of A′, B, C, D (single), F, G, H′, K′ and L′, whereas others have a pattern of A′, B, C, D (single), F, G, HK and L′ (Akihito, 1986: 632). If formation of a single HK pore is derived, then that is a synapomorphy of *Sicyopterus, Sicydium,* and some *Awaous.* If presence of a G pore in *Awaous* excludes it from a lineage that includes sicydiines and *Stenogobius, Evorthodus, Gnatholepis,* and *Oligolepis,* then fusion of pores H′ and K′ in some *Awaous* and in *Sicyopterus* and *Sicydium* is homoplastic.

Diagnostic Characters of Sicydiines.—1–3. Pelvic fins: Sicydiine pelvic fins are highly modified into a rounded sucking disc (Sakai and Nakamura, 1979: fig. 1). The three characters described here could be viewed as one, complex diagnostic character. We discuss the characters separately because each could be confused with inferred homoplastic characters in different outgroup taxa.

1. Rounded pelvic disc with posteriorly rounded pelvic bones and thickened, highly branched pelvic-fin rays, and thickened pelvic-fin spine.

Sicydiine pelvic bones are rounded posteriorly. Anterolaterally, each bone has an expanded flange that nearly reaches the midline. Pelvic-fin spines and rays

Table 2. Comparison of selected characters in five recognized sicydiine genera. Hypothesized derived character states are in upper case. Polarity of character 10 is ambiguous (see text)

Genus	*Sicyopus*	*Lentipes*	*Stiphodon*	*Sicydium*	*Sicyopterus*
Distribution	Indo-Pacific	Pacific	Pacific	Atlantic, Eastern Pacific	Indo-Pacific
Character					
1. Ascending/articular process of premaxilla	pointed	pointed	pointed	BLUNT	BLUNT
2. Premaxillary teeth	conical	MULTICUSPID ANTERIORLY, conical posteriorly	MULTICUSPID	MULTICUSPID, or MULTICUSPID ANTERIORLY, conical posteriorly	MULTICUSPID
3. Medial gap between left and right premaxillary tooth rows	absent	absent	absent	absent	PRESENT
4. Sac of replacement teeth in upper jaw	absent	absent	PRESENT	PRESENT	PRESENT
5. Horizontal dentary teeth	absent	PRESENT MEDIALLY	PRESENT	PRESENT	PRESENT
6. Lips	complete	WITH CLEFTS AND/OR CRENULATED or complete	WITH CLEFTS AND/OR CRENULATED	WITH CLEFTS AND/OR CRENULATED or complete	WITH CLEFTS AND/OR CRENULATED
7. Swelling between horizontal and conical teeth of dentary, and symphysial soft tissue	absent	absent	absent	PRESENT	absent
8. Gill rakers on ventral portion of first gill arch	present or ABSENT	present or ABSENT	ABSENT	ABSENT	ABSENT
9. Propercular-canal pores	M′, O′	M′, O′	M′, O′	M′, O′ or m′, n, o′	m′, n, o′
10. Oculoscapular-canal pores between pores H′ and L′ (see text)	H′, K′, L′	H′, K′, L′	H′, K′, L′	HK, L′	HK, L′

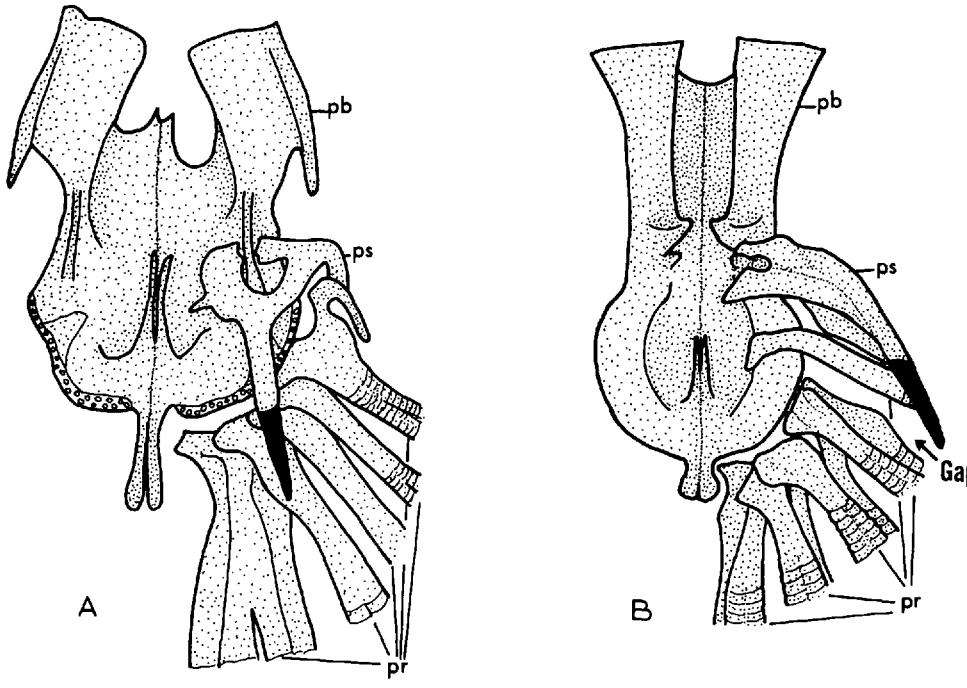

Figure 4. Diagrammatic representation of pelvic girdle in ventral view: A. *Awaous* sp., USNM 287150; B. *Sicyopus fehlmanni,* CAS-SU 52026, paratype. Right pelvic spine and rays removed; left pelvic rays shown only at proximal ends. Stippling, bone; open circles, cartilage. Non-ossified tip of pelvic spine blackened. Anterior at top. Abbreviations: pb, pelvic bones, ps, pelvic spine, pr, pelvic rays.

articulate with the pelvic bones to form a nearly round pelvic disc (Fig. 4B). Pelvic-fin spines are thick and pelvic-fin rays thick and more highly branched than in outgroup taxa (compare *Awaous,* Fig. 4A with *Sicyopus,* Fig. 4B).

2. Fleshy pads at posterior tips of pelvic-fin spines.

Sicydiines have a thick interspinal membrane or frenum that joins posterior tips of left and right pelvic-fin spines and first pelvic-fin ray to form the anterior edge of the rounded pelvic disc. The membrane is particularly thick at distal tips of pelvic-fin spines forming what Hoese (1984) called fleshy pads. Larson (1990: 48) diagnosed *Pleurosicya* and close relatives by an anteriorly folded frenum and flattened, rounded pelvic-fin spine lobes. *Pleurosicya* and close relatives are unlike sicydiines in that each pelvic lobe is a separate, posteriorly directed, fleshy flap (Larson, 1990: fig. 43), rather than a pad at the posterior tip of a pelvic-fin spine.

Birdsong et al. (1988: 197) listed a ". . . fleshy (cartilaginous) tip on each pelvic fin spine . . ." as diagnostic of *Awaous* and sicydiines. It is questionable that part of a dermal bone such as the pelvic spine is cartilage although the tip stains blue when placed in alcian blue and appears superficially cartilaginous. The ossified portion of the pelvic-fin spine is blunt (see Fig. 4 and below) and capped with a hard, translucent tip of unknown composition. Regular appearance of the blunt, ossified portion of the pelvic spine with flexible to hard, translucent tip in numerous gobioid taxa, including *Rhyacichthys, Stenogobius, Awaous, Periophthalmus, Rhinogobius, Evorthodus,* as well as sicydiines, suggests it is unlikely that the pelvic spine tip has been decalcified (Fig. 4). Furthermore, although the flexible tip is most obvious on the pelvic spine, numerous gobies examined, such as

Evorthodus, Periophthalmus, and sicydiines, have such tips on all spines. Systematic significance of fin spines with translucent tips is unknown; the character complex is possibly diagnostic of gobioids or a larger group of acanthomorphs, although it is absent in the eleotridid *Hypseleotris.*

3. Pelvic-fin spine and first ray close together at their proximal ends, and separated from remaining four pelvic-fin rays.

A newly described, complex diagnostic character of sicydiines involves relative position of pelvic-fin rays and spines. In outgroup taxa, pelvic-fin rays and spines occur in at least two arrangements: pelvic-fin spine and rays are in line with each other, as in *Hypseleotris* and *Periophthalmus*; or, the pelvic-fin spine is rotated medially, as in *Stenogobius, Evorthodus, Rhinogobius,* and *Awaous* (Fig. 4A). Sicydiines have an apparently unique condition of pelvic-fin spine and adjacent (=first) fin ray close to each other, especially at their proximal ends, and separated from the remaining four pelvic-fin rays by a distinct gap (Fig. 4B). Furthermore, proximal ends of the spine and first ray extend farther onto the pelvic bone than do the proximal ends of the four remaining rays (Fig. 4B; Sakai and Nakamura, 1979: fig. 4A).

4. Jaw suspensorium: Palatine bone with long dorsal process that articulates with lateral ethmoid.

Harrison (1989) reviewed variation in one portion of the jaw suspensorium, the palatopterygoquadrate complex, which varies among gobioids in relative size and arrangement of palatine, ectopterygoid, and quadrate bones. Harrison (1989: 343) considered sicydiines to have a derived palatopterygoquadrate architecture and palatine bone, and acknowledged homoplasy in numerous characters used to diagnose sicydiines or to infer their relationships to other gobioids. Some hypothesized derived characters of sicydiine palatopterygoquadrate architecture are found in other gobioids such as oxudercines, amblyopines, the microdesmid, *Microdesmus longipinnis,* and *Evorthodus* (Harrison, 1989: table 1). The derived character of a palatine bone with a long dorsal process that articulates with the lateral ethmoid may be considered diagnostic of sicydiines when compared to *Awaous* (Harrison, 1989: fig. 6); although, shape and relative size of the dorsal palatine process varies among other possible close sicydiine relatives, such as *Stenogobius* (Harrison, 1989: fig. 7).

5. Jaws: Dorsal expansion of premaxilla, no differentation between ascending and articular processes, and reduction in rostral cartilage.

In *Awaous* and other outgroup taxa, the premaxillary ascending process is narrow and elongate, lying medial to a flat, broad articular process (Harrison, 1989; Fig. 5A). A large rostral cartilage spans the midline, uniting the ascending processes, as in plesiomorphic gobioids (Springer, 1983: fig. 7).

Harrison (1989) described an additional diagnostic character of sicydiines as dorsal expansion of the premaxilla. Correlated with this expansion is the lack of differentiation between ascending and articular premaxillary processes and a reduction of the rostral cartilage, as in *Sicyopus* (Fig. 5B). *Sicyopterus* and *Sicydium* are distinguished by a premaxilla with a short, blunt ascending/articular process (Fig. 5D), as opposed to a more narrow, and somewhat elongate ascending/articular process in *Stiphodon* (Fig. 5C). A small rostral cartilage that cannot be seen in lateral view lies medial to the ascending/articular process in *Sicydium* and *Sicyopterus* (Fig. 5D). A short, blunt ascending/articular process is possibly synapomorphic for *Sicyopterus* and *Sicydium.*

6. Mouth: Adnate tongue.

The sicydiine tongue is fused to the mouth floor, or free only at its anterior tip

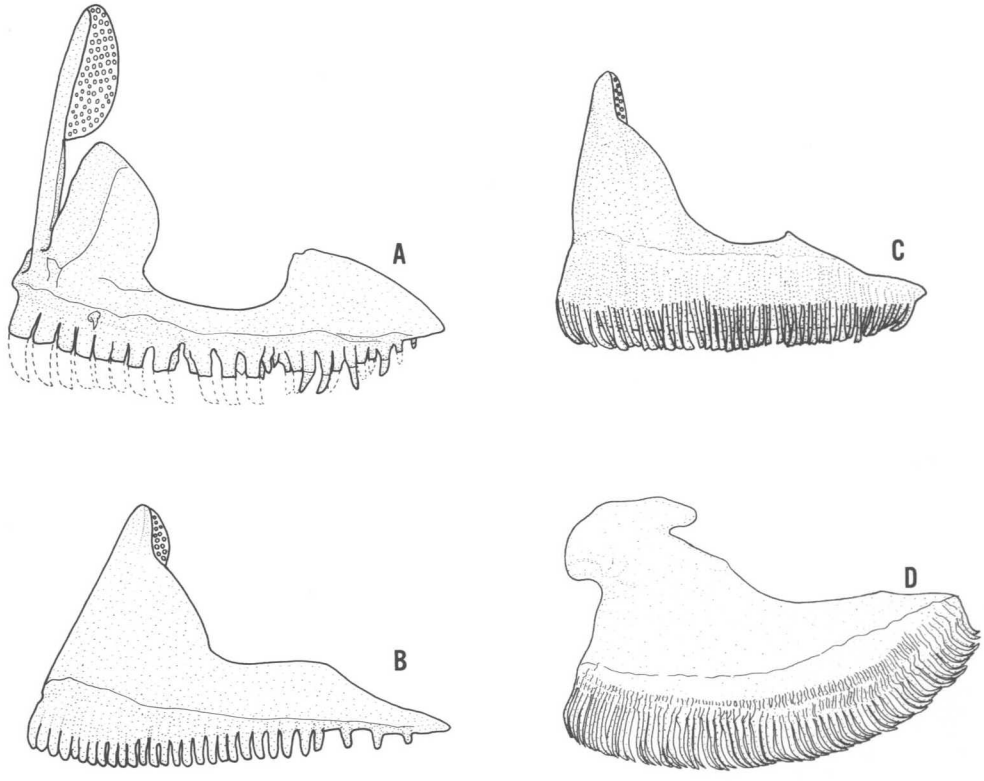

Figure 5. Diagrammatic representation of left premaxilla in lateral view: A. *Awaous* sp., USNM 287150; B. *Sicyopus nigriradiatus,* CAS 67359, paratype; C. *Stiphodon caeruleus,* CAS 67316, paratype; D. *Sicyopterus lividus,* CAS 67497, paratype. Stippling, bone; open circles, rostral cartilage. Dashes approximate size and position of tooth tips lost in preparation. Anterior to left.

(Hoese, 1984: 590). This character was described by Parenti (1991: fig. 9) as: skin covering basihyal and floor of mouth. Hoese also used "tongue fused to floor of mouth" in part to diagnose two subfamilies, Oxudercinae and Amblyopinae, that elsewhere (Harrison, 1989), and in the present study, are not considered closest relatives of sicydiines. Oxudercines and amblyopines do not share the 3-12210 dorsal pterygiophore pattern or one epural bone. For the moment, we view an adnate tongue as homoplastic in sicydiines, oxudercines, and amblyopines.

Note on Relationships among Sicydiine Genera

Phylogenetic relationships, including monophyly, of sicydiine genera are under study by the senior author. It is not our purpose to present a detailed phylogenetic analysis among sicydiine genera. Results of a future phylogenetic analysis could require generic reallocation of some of the approximately 95 nominal sicydiine species, including those we describe herein. Nonetheless, generic assignment of our new species is meaningful within a preliminary phylogenetic systematic hypothesis (Parenti, 1991: fig. 9).

Selected characters to distinguish among sicydiine genera, compiled from Akihito and Meguro (1979), Sakai and Nakamura (1979), Pezold (1993), and personal observation, are summarized in Table 2. Polarity is assessed based on comparison

with outgroup taxa. *Sicyopus* is the most plesiomorphic sicydiine genus; premaxillary and dentary jaw teeth are unicuspid or weakly tricuspid, sometimes caniniform, and uniserial (Fig. 5B), and there are no horizontal teeth on the dentary. Monophyly of *Sicyopus* is doubtful. The other four genera, *Lentipes, Stiphodon, Sicyopterus,* and *Sicydium,* are together diagnosed as monophyletic by at least medial and anterolateral portion of premaxilla with an external row of thin, close-set, bi- or tricuspid teeth (Fig. 5C–D), and dentary with an external row of horizontal teeth (Sakai and Nakamura, 1979: fig. 8). A less-inclusive monophyletic group comprising *Stiphodon, Sicyopterus,* and *Sicydium* is diagnosed as monophyletic by a fleshy sac above the upper jaw that is replete with replacement teeth in various ontogenetic stages (Mochizuki et al., 1991), hence one common name, toothed-lip.

Lentipes might be described as having an intermediate state in dentition between *Sicyopus* and *Stiphodon, Sicyopterus,* and *Sicydium.* A sister-group relationship between the two recognized species currently placed in *Lentipes, L. concolor* and *L. armatus* Sakai and Nakamura, has not been confirmed and monophyly of *Lentipes* is, therefore, untested. *Parasicydium* has dentition like *Lentipes*; however, it also has the diagnostic character of *Sicydium* (Akihito and Meguro, 1979: fig. 2), a large, fleshy, swelled area between posterior extent of labial (horizontal) and unicuspid dentary teeth. Furthermore, *Parasicydium* has the oculoscapular-canal pore pattern of *Sicydium* and *Sicyopterus,* rather than that of *Lentipes.*

Sicyopterus and *Sicydium* share the putative synapomorphies of a short, blunt ascending/articular process and unique oculoscapular-canal pore pattern (Pezold, 1993).

Systematics

Family Gobiidae
Subfamily Sicydiinae Bleeker, 1874

Diagnosis.—Branchiostegal rays 4–5; one epural bone; dorsal pterygiophore formula 3-12210; tongue adnate (skin covering basihyal bone and mouth floor); pelvic disc rounded; pelvic bones rounded posteriorly; pelvic-fin rays thickened and highly branched; pelvic-fin spine thickened; pelvic-fin spine with fleshy pad at distal tip; pelvic spine and first ray separated from remaining four pelvic rays by distinct gap; premaxilla expanded dorsally; premaxillary between ascending and articular processes undifferentiated; rostral cartilage small; palatine bone with long dorsal process that articulates with lateral ethmoid.

Composition.—Approximately 95 nominal species classified currently in five genera: *Sicyopus* Gill, 1863; *Lentipes* Günther, 1861; *Sicydium* Valenciennes, in Cuvier and Valenciennes, 1837 (tentatively including *Parasicydium* Risch, 1980); *Sicyopterus* Gill, 1860; and *Stiphodon* Weber, 1895.

Frequency distributions of selected meristic characters of the five new species are given in Table 3.

Subfamily-group Name Sicydiinae.—Sicydiaphiinae Koumans, 1931, is used widely as the name for the gobiid subfamily that includes toothed-lip or rock-climbing gobies of the genera *Sicyopus, Lentipes, Stiphodon, Sicydium,* and *Sicyopterus.* Sicydiinae Bleeker, 1874, is the valid name for this subfamily. Bleeker (1874) divided his subfamily "Gobiiformes" into eight "groupes," one of which was the Sicydiini, that we recognize as a subfamily. Bleeker's (1874) Sicydiinae comprised five genera, one of which contained three subgenera (Table 1). Koumans (1931) removed *Tridentiger* from the Sicydiinae, synonymized *Microsicydium* under *Si-*

Table 3. Frequency distributions of selected meristic characters for new sicydiine species

Species	Second dorsal-fin formula		Anal-fin formula	
	I,9	I,10	I,10	I,11
Sicyopus nigriradiatus	7		7	
Sicyopus fehlmanni	10		8	2
Sicyopterus lividus		23	22	
Sicyopterus eudentatus		13	13	
Stiphodon caeruleus	15		15	

Species	Pectoral-fin rays (left side)								Branched caudal-fin rays				
	13	14	15	16	17	18	19	20	12	13	14	15	16
Sicyopus nigriradiatus		6	1							3	3	1	
Sicyopus fehlmanni			10						1	9			
Sicyopterus lividus					3	20					20	1	1
Sicyopterus eudentatus							3	10			3	10	
Stiphodon caeruleus	1	14								15			

Species	Teeth on premaxilla							Teeth on dentary			
	10–19	20–39	40–59	60–79	80–99	100–119	120+	1–5	6–10	11–15	16–20
Sicyopus nigriradiatus		5									
Sicyopus fehlmanni	8	2								4	6
Sicyopterus lividus				4					4		
Sicyopterus eudentatus							4			2	2
Stiphodon caeruleus			5					5			

cyopterus, and expanded the Sicydiinae to a total of eleven genera (Table 1). Koumans did not use the name Sicydiinae for the group, however, but created a new name for it, Sicydiaphiinae, derived from a combination of *Sicydium* and *Aphia,* an action contrary to the rules for formation of family-group names (International Code of Zoological Nomenclature, 1985).

Hoese (1984: 590), without specifying the genera, considered the Sicydiinae to include ". . . about 5 or more genera . . ." that formed a part of Koumans' (1931, 1953) Sicydiaphiinae. Birdsong et al. (1988), Harrison (1989), and Parenti (1991) assumed that the unspecified genera comprised *Sicyopus, Lentipes, Sicydium, Sicyopterus,* and *Stiphodon.* Risch (1980) considered his new genus, *Parasicydium,* from the Ivory Coast, to be most closely related to *Sicydium*; we tentatively treat these two genera as synonyms, although only one specimen of *Parasicydium* has been examined as part of this study.

Biology.—Sicydiine gobies occur in tropical and subtropical insular and coastal streams. All are restricted to freshwater as juveniles and adults. Life history is amphidromous (Myers, 1949; Maciolek, 1978; Fukui, 1979; McDowall, 1992), a specialized diadromous pattern common to tropical insular stream gobioids (Ryan, 1991). Minute adhesive eggs are spawned on rock surfaces, fertilized, and hatch within a day or two (Manacop, 1953). Transparent, larval hatchlings are carried passively to the ocean where they spend several weeks as ichthyoplankton (Fitzsimons et al., 1990). Developed larvae transform at a stream mouth prior to ascending the watercourse to an upstream habitat (Erdman, 1961, 1986). Other prominent stream fauna (e.g., some other gobioids, palaeomonid and atyid crustaceans, and neritid gastropods) display similar amphidromous cycles. They, like sicydiines, are highly fecund, producing hundreds to thousands of eggs per female depending upon her size. Restriction of stream-established individuals to freshwater and a relatively short larval life are correlated with high regional endemism.

Strong pelvic-fin suction discs enable postlarval and juvenile sicydiines to climb steep gradients, even waterfalls (Maciolek, 1978; Fukui, 1979: fig. 2) with overhanging wet rock surfaces. The disc also allows positioning on hard substrate in current and may function similarly in oviposition, which occurs mainly on the lower faces of rocks. Optimal sicydiine habitat appears to be the more pristine steams with noticeable gradient. *Lentipes* and *Sicyopus* are usually found in smaller streams with moderate to steep gradients.

Fehlmann (1957, 1960) arbitrarily divided Arakitaoch stream, Babelthuap, into four named zones: mangrove zone, from stream mouth to level of highest tide; lower graded zone, from level of highest tide to lower reaches of stream-bottom bedrock; cascade zone, from lower to upper reaches of stream-bottom bedrock; and source zone, from upper reaches of stream-bottom bedrock to source of the stream (e.g., a spring). Of the 144 specimens of *Sicyopus fehlmanni* collected by the George Vanderbilt Foundation expeditions of 1955–1957, 132 (92%) were collected in the cascade zone, and 12 (8%) were taken in the source zone or lower graded reaches of the stream. Other fish species found in association with *S. fehlmanni* include gobioids *S. zosterophorum* (Bleeker), *Sicyopterus micrurus* (Bleeker), *Eleotris fusca* (Bloch in Schneider), *Ophiocara aporos* (Bleeker), and *Stigmatogobius* sp., freshwater eels, family Anguillidae, and the perch-like flagtails, family Kuhliidae (Fehlmann, 1960, and manuscript notes).

Sicydiines are omnivorous, although some genera (viz. *Sicyopterus, Sicydium,* and *Stiphodon*) are mostly herbivorous. *Sicyopterus* species have been observed rasping epilithic organisms (attached algae, protozoans, and small metazoans) from rocks using the pelvic disc to maintain position and enhance leverage. Dentition (with replaceable teeth) is correlated with such feeding behavior (Mochizuki et al., 1991). Principal food and space competitors include other sicydiines, gastropod mollusks, and smaller decapod crustaceans. Indigenous predators are piscivorous gobioids (especially eleotridids), kuhliid and anguillid fishes, and larger palaeomonid crustaceans.

Noticeable sexual dimorphism or dichromatism is characteristic of mature sicydiines. In addition to genital papillae (usually pointed in males, rounded or lobed in females), differences may include relative size and shape of median fins, squamation, dentition, and especially live coloration. Males are more obtrusive because of striking colors or contrasting patterns. In *Stiphodon,* for example, females of most species are similarly dull or drab, but conspecific males are more boldly patterned or colored (Ryan, 1986). In *Sicyopterus,* male dorsal fins tend to be larger with longer anterior spines in the first dorsal fin. Male *S. stimpsoni* Gill have been observed in a gradation of tonal patterns from "tuxedo" (uniformly black dorso-laterally, white ventrally), through prominent lateral striping to a "camouflage" of dark and light brown mottling similar to females (J. A. Maciolek, pers. obs.). Generally, the more striking male coloration is associated with nuptial condition or territoriality. Nuptial male *S. stimpsoni* develop a bright iridescent blue subterminal band on the anal fin. Male *S. pugnans* (Grant) have a prominent black "V" on light membranes of the lower jaw. *Sicyopus jonklaasi* Klausewitz and Henrich from Sri Lanka is called the "lipstick goby" in English because males have a bright red upper lip and caudal peduncle (Klausewitz and Henrich, 1986). As an exception to the foregoing, ripe female *Sicyopus leprurus* Sakai and Nakamura, from the Japanese Archipelago and the Marianas, and *Sicyopus fehlmanni* from Palau, have blood-red bellies (Akihito et al., 1984: plate 256B; J. A. Maciolek, pers. obs.; Fehlmann, manuscript notes). Maciolek (1978) described an extreme difference between sexes in *Lentipes concolor* (Gill) that led to initial description of males and females as separate species. Differences involve color-

ation, dorsal-fin size and spacing, squamation, dentition, and head shape. Because males of different species of sicydiines are easier to distinguish from each other than are females, field recognition of the species, as well as species diagnoses, are based mostly on male morphology.

Sicyopus Gill, 1863

Sicyopus Gill, 1863: 262 [type species *Sicydium zosterophorum* Bleeker, 1857, by subsequent designation of Bleeker 1874: 311].

Sicyopus nigriradiatus new species
Figures 5B, 6

Sicyopus sp.—Maciolek and Ford, 1987: 628–629, table 2, Nanpil-Kiepw River, Ponape.

Diagnosis.—*Sicyopus nigriradiatus* is distinguished from congeners and all other Ponapean sicydiines by the median and pectoral-fin rays blackened in males and females.

Description—First dorsal fin VI, depressed fourth and fifth spines extend posteriorly to second dorsal-fin insertion; second dorsal fin I,9; anal fin I,10; pectoral fin 14–15 [15]; pelvic fin I,5, interspinal membrane or frenum thick; branched caudal-fin rays 13–15 [13]; vertebrae 10 + 16 = 26; no rakers on ventral portion of first gill arch.

Lateral scales in 33–44 [38] irregular rows. Predorsal scales absent; scales cycloid, present on dorsum from first dorsal-fin insertion and on body from perpendicular through sixth first dorsal-fin spine onto caudal-fin base; caudal scales largest. Two preopercular-canal pores (M′ and O′). Oculoscapular-canal pore pattern A′, B, C, D (single), F, H′, K′ and L′.

Mouth terminal, maxilla extending to below anterior portion of orbit. Lips thick, fleshy and entire. Cheeks swollen causing eye to appear oval in lateral view. Premaxillary and dentary teeth unicuspid, uniserial; no horizontal teeth on dentary. Short, fleshy tubular anterior naris about halfway between anterior margin of eye and posterior extent of upper lip; simple posterior naris anterior to eye.

Head slightly pointed in profile, head length 27–28 [28]; snout length 9–10 [10]; eye diameter 5–6 [6]; pelvic-fin length 13–14 [14]; pectoral-fin length 21–22 [21]; pre-anal length 62–65 [62]; pre-dorsal length 38–40 [39].

Preserved Color.—Head dark brown dorsally and anteriorly, including lips, ventrum and cheeks pale to light brown. Medial dark brown to black stripe on nape ending before first dorsal. Body with five diffuse, dusky, dorso-lateral bands ending dorsal to midline, first band ending at first dorsal origin, second between first and second dorsal fins, slightly overlapping second dorsal-fin origin, third at about fifth ray of second dorsal fin, fourth just posterior to second dorsal fin, and fifth on caudal peduncle. Lateral stripe pale brown. Dusky stripe ventral to body midline extending from pectoral fin to caudal peduncle. Ventral surface pale yellow to pale green, with scattered dark brown to black chromatophores in males. Pectoral-, dorsal- and caudal-fin with black rays and hyaline membranes. Pelvic disc pale yellow. Anal fin with submarginal black stripe and pale yellow margin. Inter-radial membranes with scattered dark brown to black chromatophores. Background coloration pale yellow to pale green.

Live Color.—Pattern as described for preserved color above. Background coloration light to medium yellowish green. Chromatophores dark brown to black. Specimens from Lehn Mesi R. with orange spots on posterior half of body ventral to midline.

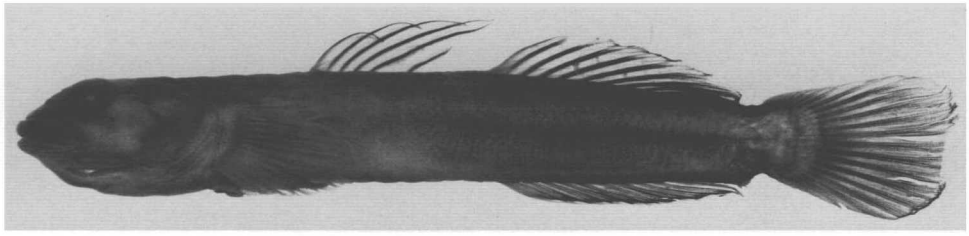

Figure 6. *Sicyopus nigriradiatus*, n. sp. Holotype, CAS 67464, male, 37.0 mm SL, Nanpil-Kiepw River, Ponape (Pohnpei), E. Caroline Is.

Comparisons.—*Sicyopus nigriradiatus* is more fully-scaled and darkly pigmented than *Sicyopus leprurus*, a species scaled only on the caudal peduncle and uniformly tan, rarely with bars (Sakai and Nakamura, 1979).

Remarks.—Maciolek and Ford (1987: 631) included an addendum that stated, in part: "We collected fauna from a few other Ponapean streams in July 1985 [should read 1986] after this manuscript had been completed . . . New collections . . . yielded a sicydiine goby that appears to be different from those reported herein, but verification of its species status must await detailed analysis." Specimens from the Lehn Mesi R., collected in the summer of 1986, are distinguished from the rest of the material, collected in the spring, by having orange spots on the body in life, as described above. These orange spots most likely represent nuptial coloration; that is, seasonal variation rather than specific differentiation.

Distribution.—Known from Nanpil-Kiepw, Soundah, Ninduwi, and Pilen Salapwuk drainages, Ponape (Fig. 1).

Etymology.—*nigriradiatus*, a noun in apposition, from Latin roots *nigris*, meaning black, and *radiatus*, meaning with rays, in reference to blackened median- and pectoral-fin rays in both sexes.

Material examined.—19 specimens, 27.0–56.0 mm SL, including holotype; Nanpil-Kiepw, Soundah, Ninduwi, and Pilen Salapwuk drainages. Holotype: CAS 67464, male 37.0 mm SL, coll. J. A. Maciolek and J. Ford, 12 Apr 1982, fourth trib. of Nanpil R., Ponape (Fig. 1).

Paratypes, same data as holotype: CAS 67359 (male, 38.0 mm SL, cleared and stained solely with alizarin); CAS 67459 (female, 52.5 mm SL); CAS 67460 (female, 48.5 mm SL); CAS 67461 (female, 38.0 mm SL); CAS 67462 (female, 38.0 mm SL); and CAS 67463 (male, 42.5 mm SL). "Tomwara" or Ninduwi str., just S of Dolen Pwakorokot, 55 m elev., coll. J. A. Maciolek and J. Ford, 6 July 1986, CAS 67445 (2, 28.0–45.0 mm SL), ROM 64668 (1, ex. CAS 67445); Pilen Salapwuk R., lower fork, trib. to Lehn Mesi R., 200 m elev., coll. J. A. Maciolek and J. Ford, 11 July 1986, CAS 67441 (1, 56 mm SL); Lehn Mesi R., 80 m elev., coll. J. A. Maciolek and J. Ford, CAS 67452 (4, 27.0–39.0 mm SL, including 34.0 mm SL, cleared and counterstained), BPBM 35020 (2, ex. CAS 67452); Soundah str., E trib. at road crossing, 70 m elev., coll. J. A. Maciolek and J. Ford, 5 July 1986, CAS 67450 (1, 54.5 mm SL), USNM 322469 (1, 39.5 mm SL, ex. CAS 67449).

Sicyopus fehlmanni new species
Figures 4B, 7, 8

Sicyopus vanderbilti—Fehlmann, 1960: 85, 93, 97, 98, tables 3–5, 8, 9, 13, 19, pl. 57A, Babelthuap, Palau (unpublished manuscript name).—Bright and June, 1981: 109, Babeldoab (=Babelthuap), Palau (nomen nudum).

Sicyopus sp.—Bright and June, 1981: 109, Babeldoab (=Babelthuap), Palau.

Diagnosis.—*Sicyopus fehlmanni* is distinguished from congeners by a derived color pattern consisting of small, discrete, black spots distributed on dorsal and lateral surface of head, and dorsal and anal inter-radial membranes, and body with five to seven diffuse, dusky, dorso-lateral bands descending only to midline in some specimens.

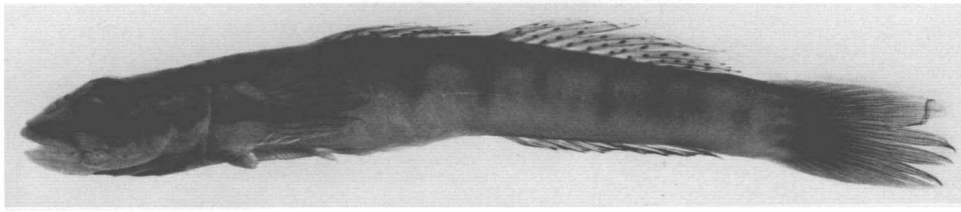

Figure 7. *Sicyopus fehlmanni*, n. sp. Holotype CAS-SU 52029, male, 39.0 mm SL, Babelthuap Island, Palau (Belau), W. Caroline Is.

Description.—First dorsal fin VI, depressed sixth spine extends posteriorly nearly to second dorsal-fin insertion; second dorsal fin I,8–10 [I,9]; anal fin I,9–11 [I,10]; pectoral fin 15; pelvic fin I,5, interspinal membrane or frenum thick; branched caudal-fin rays 12–13 [13]; vertebrae 10 + 16 = 26; one to several short, knob-like rakers on ventral portion of first gill arch.

Lateral scales in 22–33 [22] irregular rows. Predorsal scales absent; scales cycloid, present on dorsum from second dorsal-fin insertion and on body from perpendicular through posterior two or three dorsal-fin rays onto caudal-fin base; caudal scales largest. Two preopercular-canal pores (M′ and O′). Oculoscapular-canal pore pattern A′, B, C, D (single), F, H′, K′ and L′.

Mouth terminal, maxilla extending to below anterior portion of orbit. Lips thick, fleshy and entire. Cheeks swollen causing eye to appear oval in lateral view. Premaxillary and dentary teeth uniserial, anterior teeth weakly tricuspid, others unicuspid; anterior and posterior dentary teeth separated by one or two enlarged, caniniform teeth; no horizontal teeth on dentary. Short, fleshy tubular anterior naris about halfway between anterior margin of eye and posterior extent of upper lip; simple posterior naris anterior to eye.

Head bluntly pointed in profile, head length 19–25 [19]; snout length 6–10 [6]; eye diameter 4–7 [4]; pelvic-fin length 13–15 [13]; pectoral-fin length 15–18 [15]; pre-anal length 53–60 [53]; pre-dorsal length 33–43 [33].

Preserved Color.— Coloration highly variable from pale females and juveniles to darkly pigmented adult males. Dark brown lateral stripe from snout tip through upper lip, along cheek, pectoral-fin base and extending onto middle pectoral rays. Dorsal and lateral surface of head with small, discrete, dark brown spots. Ventral surface of head between branchiostegal rays with faint to dark brown, inverted Y-shaped mark. Body with five to seven diffuse, dusky, dorso-lateral bands ending at midline, first band ending anterior to first dorsal-fin origin, second between first and second dorsal fins, slightly overlapping second dorsal-fin origin, third at about fifth second dorsal-fin ray, fourth just posterior to second dorsal fin, and fifth on caudal peduncle. Pectoral-, dorsal-, anal-, and caudal-fin rays dusky with pale yellow margins; dorsal and anal inter-radial membranes with discrete dark brown chromatophores. Pelvic disc pale yellow. Background coloration light to medium brown, russet dorsally, tan ventrally.

Live Color (from Fehlmann's manuscript notes).—Gravid females with bright, blood-red belly; juvenile females may have an orangish belly. Belly in adult males light brown or reddish brown. In both sexes, the anterior portion of the pelvic frenum may be deep russet or the same pale tan as the remainder of the pelvic disc. This russet color appears most frequently in the barred and more heavily pigmented specimens.

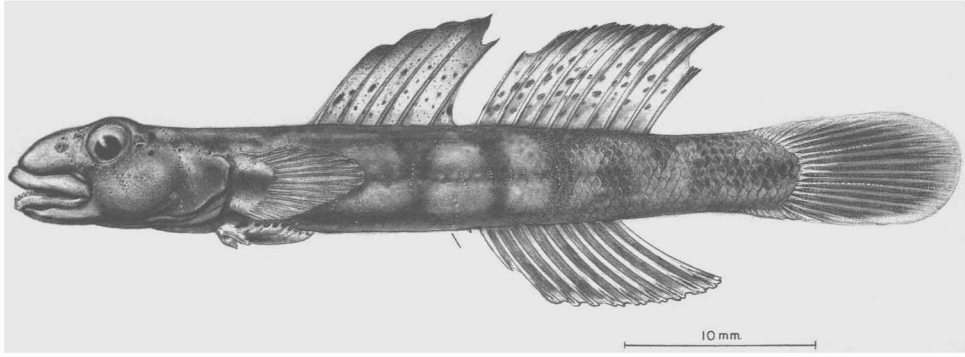

Figure 8. *Sicyopus fehlmanni*, n. sp. Paratype, CAS-SU 52025, male, 40.0 mm SL, Babelthuap Island, Palau (Belau), W. Caroline Is. Drawn by Janet Roemhild Canning, staff artist of George Vanderbilt Foundation.

Comparisons.—*Sicyopus fehlmanni* is distinguished from all other sicydiines by its unique pigmentation pattern. Discrete spots on the dorsal-fin membranes and blood-red bellies in ripe females are two characters shared by *S. fehlmanni* and *S. leprurus* Sakai and Nakamura (1979) from the Japanese Archipelago, and Guam and Rota in the Marianas. *Sicyopus leprurus* differs from *S. fehlmanni* in being uniformly tan, rarely with bars (Sakai and Nakamura, 1979).

Remarks and Etymology.—The name, *Sicyopus vanderbilti,* was chosen for this species by Herman Adair Fehlmann and appeared, without description, in his unpublished Ph.D. dissertation (Fehlmann, 1960) and as a nomen nudum in Bright and June (1981). We have chosen instead to name the species *Sicyopus fehlmanni* in honor of Fehlmann who participated in collection of the type specimens and recognized the species as new. Details of live coloration have been abstracted from Fehlmann's manuscript notes. The specimen chosen by Fehlmann as holotype, CAS-SU 52025, has one spine and one unbranched, segmented ray, rather than one spine and one branched, segmented ray on the first anal-fin pterygiophore (Table 3). A male specimen more representative of *S. fehlmanni* was chosen from CAS-SU 52029 as holotype (Fig. 7). A drawing (Fig. 8), made by George Vanderbilt Foundation staff artist Janet Roemhild Canning, is probably based on CAS-SU 52025, but does not illustrate the anal-fin ray formula of that specimen. Unbranched, segmented anal-fin rays are found in other gobiids, for example, the diminutive *Trimmatom* (Winterbottom, 1989).

Photographs of the lower graded, cascade, and source zones of Arakitaoch stream, Babelthuap, one of the type localities, appear in Fehlmann (1960: pls. 10–12). Another possible type locality is shown in Bayer and Harry-Rofen (1957: pl. 12, fig. 20); however, that locality is identified only as ". . . a small stream on Arekalong Peninsula of northern Babelthuap."

Distribution.—Known only from Babelthuap and Koror islands, Palau (Fig. 2).

Material Examined.—144 specimens, 16.0–51.0 mm SL, including holotype; Babelthuap and Koror islands, Palau. Holotype: CAS-SU 52029, male, 39.0 mm SL, Babelthuap Is., Ngardmau Municipality, Amekaud R., N. fork, cascade zone, 7°33′50″N, 134°33′39″E, coll. GVF 1957 Palau Is. Exped., 10 Oct 1957, GVF Sta. 1957-38C.

Paratypes, same data as holotype: CAS-SU 69693 (ex. CAS-SU 52029) (45, 30 females, 15 males, 20.0–36.0 mm SL). Koror Is.: Tengyoi str., cascade zone, 7°20′16″N, 134°30′36″E, coll. GVF 1955 Palau Is. Exped., 25 Sep 1955, GVF Sta. 1955-178, CAS-SU 52017 (male, 24.0 mm SL). Babelthuap

Is.: Ngeremeskang R., cascade zone, 7°32'50"N, 134°35'47"E, coll. GVF 1955 Palau Is. Exped., 18 Oct 1955, GVF Sta. 1955-241, CAS-SU 52018 (3: 2 females, 1 male, 28.0–42.0 mm SL); Aimeliik Municipality, Iklong str. (trib. to Alsemith R.), about 0.6 km E of Ngchemliangel village, cascade zone, 7°27'32"N, 134°29'54"E, coll. GVF 1955 Palau Is. Exped., 1 Nov 1955, GVF Sta. 1955-268, CAS-SU 52019 (9: 4 females, 5 males, 28.0–51.0 mm SL), BPBM 35016 (4: 2 females, 2 males, ex. CAS-SU 52019): Aimeliik Municipality, Imengelngal str. (trib. to Alsemith R.), about 1.2 km NE of Ngchemliangel village, cascade zone, 7°27'30"N, 134°30'40"E, coll. GVF 1955 Palau Is. Exped., 1 Nov 1955, GVF Sta. 1955-269, CAS-SU 52020 (4: 2 males, 2 females: 28.0–43.0 mm SL); Airai Municipality, Arakitaoch str., N. fork, about 0.7 km SE of Ngarekeai village, lower graded reaches, 7°23'29"N, 134°31'18"E, coll. GVF 1956 Palau Is. Exped., 31 Oct 1956, GVF Sta. 1956-170B, CAS-SU 52021 (female, 29.0 mm SL); Airai Municipality, Arakitaoch str., N. fork, about 0.72 km SE of Ngarekeai village, cascade zone, 7°23'35"N, 134°31'30"E, coll. GVF 1956 Palau Is. Exped., 4 Nov 1956, GVF Sta. 1956-170C, CAS-SU 52022 (10: 8 females, 2 males, 25.0–38.0 mm SL), USNM 322472 (4: 3 females, 1 male, ex. CAS-SU 52022); Airai Municipality, Arakitaoch str., N. fork, about 0.78 km SE of Ngarekeai village, source zone, 7°23'38"N, 134°31'40"E, coll. GVF 1956 Palau Is. Exped., 5 Nov 1956, GVF Sta. 1956-170D, CAS-SU 52023 (male, 22.0 mm SL); Airai Municipality, Arakitaoch str., S. fork, about 0.9 km SE of Ngarekeai village, cascade zone, 7°23'17"N, 134°31'38"E, coll. GVF 1956 Palau Is. Exped., 26 Nov 1956, GVF Sta. 1956-170G, CAS-SU 52024 (34: 20 females, 14 males, 16.0–41.0 mm SL), ROM 64669 (4: 2 males, 2 females, ex. CAS-SU 52024), CAS-SU 52025 (male, 40.0 mm SL), CAS-SU 52026 (8: 5 females, 3 males, 25.0–35.0 mm SL, cleared and stained solely with alizarin); Airai Municipality, Arakitaoch str., S. fork, about 0.95 km SE of Ngarekeai village, source zone, 7°23'17"N, 134°31'44"E, coll. GVF 1956 Palau Is. Exped., 27 Nov 1956, GVF Sta. 1956-170H, CAS-SU 52027 (10: 7 females, 3 males, 23.5–39.0 mm SL); and Airai Municipality, Arakitaoch str., N. fork, about 0.72 km SE of Ngarekeai village, cascade zone, 7°23'35"N, 134°31'30"E, coll. GVF 1957 Palau Is. Exped., 26 Sep 1957, GVF Sta. 1957-18C, CAS-SU 52028 (4: 3 females, 1 male, 24.0–29.0 mm SL).

Sicyopterus Gill, 1860

Sicyopterus Gill, 1860: 101, as a subgenus of *Sicydium* Valenciennes, in Cuvier and Valenciennes, 1837 [type species *Sicydium* (*Sicyopterus*) *stimpsoni* Gill 1860: 101 by original designation].

Sicyopterus lividus new species
Figures 5D, 9, 11A, 12A

Sicyopterus sp. 1.—Maciolek and Ford, 1987: 628–629, table 2, Nanpil-Kiepw River, Ponape.

Diagnosis.—*Sicyopterus lividus* is distinguished from congeners by a derived color pattern of cobalt blue background, five to six dark, nearly black, saddle bars and males with an orange caudal fin in life; in preservative, background coloration is reddish brown to black.

Description.—First dorsal fin VI, depressed second, third and fourth spines extend posteriorly beyond second dorsal-fin insertion; second dorsal fin I,10; anal fin I,10; pectoral fin 17–18 [17]; pelvic fin I,5, interspinal membrane or frenum thick; branched caudal-fin rays 14–16 [14]; vertebrae 10 + 16 = 26; no rakers on ventral portion of first gill arch.

Lateral scales in 43–57 rows, males 43–52 [44], females 53–57; dorsal surface of head unscaled; operculum and cheeks, lateral portion of body to below about middle of first dorsal fin irregularly scaled with small cycloid scales; rest of body to caudal peduncle and anterior portion of caudal-fin rays covered with imbricate ctenoid scales. Three preopercular-canal pores (M′, N and O′). Oculoscapular-canal pore pattern A′, B, C, D (single), F, HK and L′.

Mouth subterminal; simple anterior naris between anterior margin of eye and posterior extent of upper lip, simple posterior naris anterior to eye. Margin of upper lip crenulate (Fig. 12A), no distinct median or lateral cleft as in *Sicyopterus eudentatus* (Fig. 12B); fleshy papillae on underside of upper lip minute, if present. Premaxillary teeth bicuspid, of moderate width, approximately 60 teeth on each premaxilla. Dentary with 6–7 caniniform teeth, anteriormost and posteriormost teeth largest.

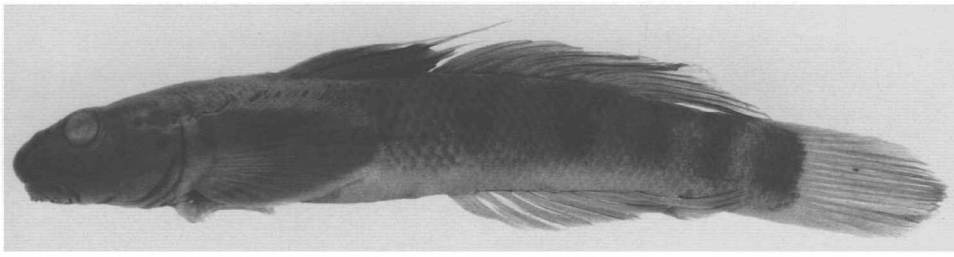

Figure 9. *Sicyopterus lividus*, n. sp. Holotype, CAS 67447, male, 51.0 mm SL, Nanpil-Kiepw River, Ponape (Pohnpei), E. Caroline Is.

Head blunt and rounded in profile, head length 22–25 [23]; snout length 9–11 [10]; eye diameter 5–6 [6]; pelvic-fin length 12–13 [13]; pectoral-fin length 21–24 [24]; pre-anal length 54–60 [57]; pre-dorsal length 33–38 [34].

Preserved Color.—Mottled brown to black dorsally; most specimens with five to six blackish saddle bars on body from just anterior to first dorsal fin to just anterior to caudal peduncle; saddles end at or above midline. Head uniformly dark brown to black from tip of snout to just posterior to orbits. Lips with scattered dark brown chromatophores. Seven black subcircular spots laterally, first obscured by pectoral fin, last on base of caudal-fin rays. Orangish spots ventral to each of five middle spots. Pectoral fin pale tan, caudal fin medium to dark brown in center with whitish margins. First and second dorsal fins brownish. Lateral ventral surface light orangish on either side of anal fin in some specimens. Pale tan ventrally except for subterminal black line on anal fin.

Live Color.—Pattern as in preserved color above. Background coloration cobalt blue with five to six black saddle bars. Caudal fin bright orange in males.

Comparisons.—*Sicyopterus lividus* is distinguished from all sicydiines by its unique color pattern, and from all other Ponapean sicydiines in having the upper-lip margin crenulate, a character shared with congeners *S. gymnauchen* (Bleeker), *S. hageni* Popta, *S. wichmanni* (Weber), *S. pugnans* and *S. longifilis* de Beaufort. Other congeners have the upper-lip margin with median and lateral clefts, as in *S. eudentatus, S. cynocephalus* (Valenciennes), *S. micrurus* (Bleeker), and *S. ouwensi* Weber. *Sicyopterus lividus* and *S. pugnans* have moderately wide, bicuspid premaxillary teeth; *S. eudentatus* has them narrow and tricuspid.

Remarks.—Meristic sexual dimorphism in gobioids has been reported previously for at least two characters, teeth and scales. In the sicydiine *Lentipes concolor,* females have more scales (20–150) than do males (2–120) (Maciolek, 1978: 356). An adult female *Evorthodus lyricus* (USNM 287149) has 40, comb-like, weakly bicuspid teeth on the dentary; whereas, an adult male has 17 canniniform teeth (see also Dawson, 1969: fig. 12).

Distribution.—Known from Nanpil-Kiepw and Lehn Mesi drainages, Ponape (Fig. 1).

Etymology.—*lividus,* an adjective, from the Latin verb *livere,* to be black and blue, in reference to blue background coloration and black saddle bars in life.

Material Examined.—109 specimens, 23.5–60.0 mm SL, including holotype; Nanpil-Kiepw and Lehn Mesi rivers. Nontype material, below, is faded or poorly preserved and therefore, not given type status. Holotype: CAS 67447, male, 51.0 mm SL, coll. J. A. Maciolek and J. Ford, Apr. 1982, fourth trib. of Nanpil R., Ponape (Fig. 1).

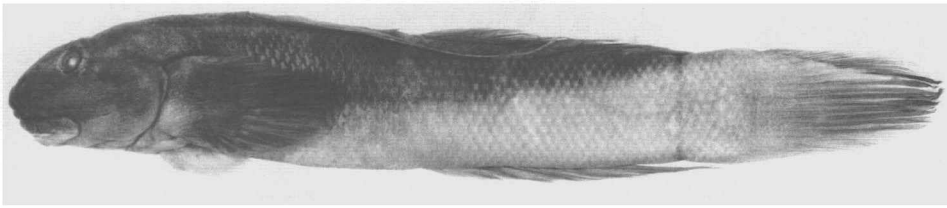

Figure 10. *Sicyopterus eudentatus,* n. sp. Holotype, CAS 67387, male, 92.5 mm SL, Nanpil-Kiepw River, Ponape (Pohnpei), E. Caroline Is.

Paratypes, same data as holotype: CAS 77367 (male, 41.5 mm SL, ex. CAS 67447); CAS 67451 (1, 50.0 mm SL); CAS 67478 (male, 55.5 mm SL); CAS 67479 (female, 54.0 mm SL); CAS 67480 (male, 53.0 mm SL); CAS 67481 (male, 53.5 mm SL); CAS 67482 (male, 52.5 mm SL); CAS 67483 (female, 47.0 mm SL); CAS 67484 (female, 50.0 mm SL); CAS 67485 (female, 48.5 mm SL); CAS 67486 (female, 43.5 mm SL); CAS 67487 (male, 57.5 mm SL); CAS 67488 (female, 48.5 mm SL); CAS 67489 (male, 57.0 mm SL); CAS 67490 (female, 42.0 mm SL); CAS 67491 (15, 44.0–52.5 mm SL, including female 49 mm SL, male 40 mm SL, cleared and counterstained); CAS 67492 (female, 49.5 mm SL, cleared and stained solely with alizarin); CAS 67493 (female, 45.5 mm SL, cleared and stained solely with alizarin); CAS 67494 (male, 56.0 mm SL, cleared and stained solely with alizarin); CAS 67495 (male, 54.0 mm SL, cleared and stained solely with alizarin); CAS 67496 (female, 52.5 mm SL, cleared and stained solely with alizarin); CAS 67497 (male, 56.0 mm SL, cleared and stained solely with alizarin); CAS 67498 (female, 55.0 mm SL, cleared and stained solely with alizarin); CAS 67499 (1, cleared and stained solely with alizarin); CAS 67500 (female, 49.5 mm SL, cleared and stained solely with alizarin); coll. J. Maciolek, Aug. 1971, CAS 67453 (8, 32.0–56.0 mm SL), USNM 322470 (4, ex. CAS 67453); coll. 8 July 1986, CAS 67454 (8, 30.0–60.0 mm SL), BPBM 35019 (4, ex. CAS 67454); Lehn Mesi R., 80 m elev., coll. J. A. Maciolek and J. Ford, CAS 67457 (21, 24.0–51.0 mm SL), ROM 64670 (4, ex. CAS 67457), CAS 67458 (3, 37.5–47.0 mm SL).

Nontype Material.—Nanpil-Kiepw R., coll. J. Maciolek, 3 Aug. 1971, CAS 67455 (7, 23.5–32.5 mm SL); Nanpil-Kiepw R., left fork, 130 m elev., coll. J. Maciolek and J. Ford, 8 July 1986, CAS 67444 (10, 44.0–57.0 mm SL).

Sicyopterus eudentatus new species
Figures 10, 11B, 12B

Sicyopterus sp. 2.—Maciolek and Ford, 1987: 628–629, table 2, Nanpil-Kiepw River, Ponape.

Diagnosis.—Distinguished from all other sicydiines by an apparently uniquely derived, high number (approximately 120 as opposed to 60) of teeth on the premaxilla, a high number (11–17 as opposed to 6–13) of caniniform teeth on the dentary, and large, fleshy papillae under upper lip as opposed to small or no papillae.

Description.—First dorsal fin VI, depressed third spine longest, extends posteriorly well beyond second-dorsal fin insertion; second dorsal fin I,10; anal fin I,10; pectoral fin 19–20 [20]; pelvic fin I,5, interspinal membrane or frenum thick; branched caudal-fin rays 14–15 [15]; vertebrae 10 + 16 = 26; no rakers on ventral portion of first gill arch.

Lateral scales in 42–50 [43] rows. Dorsal surface of head unscaled; operculum and cheeks, lateral portion of body to first dorsal fin irregularly scaled with small cycloid scales; skin thickened around scale pockets; rest of body to caudal peduncle covered with imbricate ctenoid scales; anterior portion of caudal-fin rays with smaller ctenoid or cycloid scales in one or two discrete rows dorsal and ventral to each ray. Three preopercular-canal pores (M′, N and O′). Oculoscapular-canal pore pattern A′, B, C, D (single), F, HK and L′.

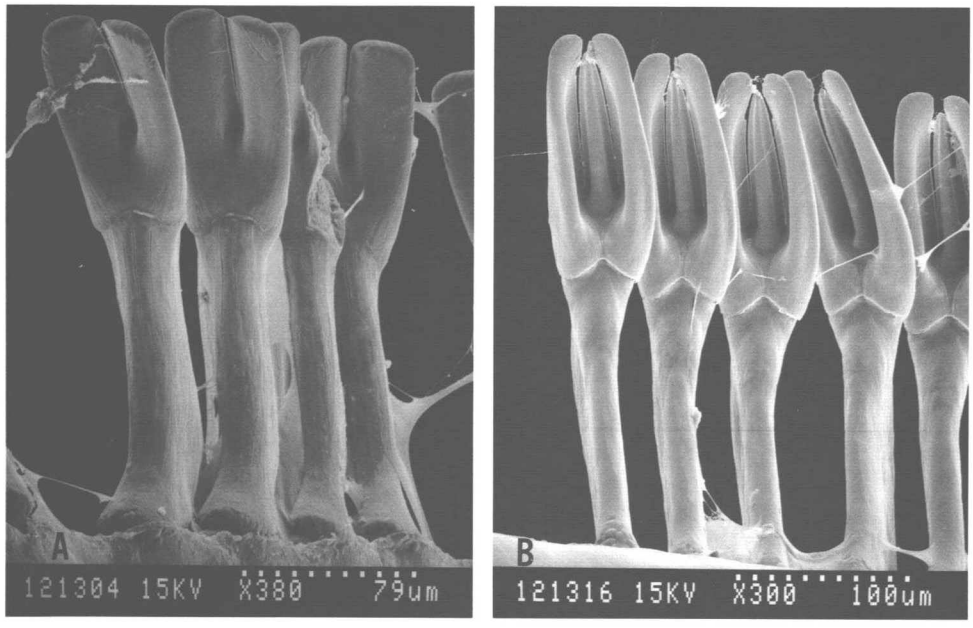

Figure 11. Scanning electron micrograph of right premaxillary teeth of A. *Sicyopterus lividus*, paratype, CAS 67497; B. *Sicyopterus eudentatus*, paratype, CAS 67395.

Mouth subterminal; upper lip with median and lateral clefts, weakly crenulate medial to lateral clefts; large, fleshy papillae on underside of upper lip; simple anterior naris about halfway between anterior margin of eye and posterior extent of upper lip; simple posterior naris anteror to eye. Premaxillary teeth tricuspid; approximately 120 on each premaxilla. Dentary with 11–17 caniniform teeth, anterior two and posterior two largest.

Head extremely blunt and rounded in profile, head length 24–26 [25]; snout length 5–6 [5]; eye diameter 4–5 [4]; pelvic-fin length 13–15 [13]; pectoral-fin length 23–24 [23]; pre-anal length 55–63 [56]; pre-dorsal length 36–38 [36].

Preserved Color.—Males with head dark brown dorsally, including upper lip, paler ventrally. Body dark brown dorsally to middle of caudal peduncle, light brown laterally from center of pectoral fin along an oblique line angled dorsally to middle of caudal peduncle, pearlish-gray ventrally. Pectoral and dorsal fins medium to dark brown. Pelvic disc pale tan with brown center. First anal-fin ray pale tan, rest of anal fin medium brown with somewhat darker marginal band. Caudal fin medium brown with dark brown stripe dorsally from caudal fin base to end of fin rays at midline, dorsal posterior margin slightly paler, four to five fin rays ventral to middle of caudal fin dark brown. Females like males except proximal part of second dorsal-fin membrane with dusky markings as spots at about dorsal-fin ray 3 and oblique vermiculated lines on posterior half of fin, and with about four indistinct narrow light dorso-lateral bars, first at origin of second dorsal, last on caudal peduncle. Anal fin with dark brown marginal band.

Live Color.—Dark brown to black head and dorsal portion of body and dorsal, pectoral, and middle and dorsal caudal-fin rays; pelvic disc and ventral surface of body pale yellow.

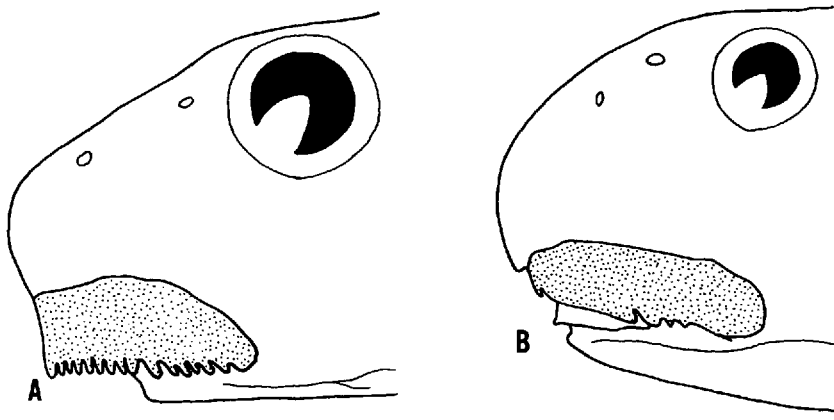

Figure 12. Diagrammatic representation of head of A. *Sicyopterus lividus,* CAS 67447; B. *Sicyopterus eudentatus,* CAS 67392. Lateralis-system pores and neuromasts not shown. Upper lip is stippled. Anterior to left.

Comparisons.—The high number (approximately 120) premaxillary teeth readily distinguishes *Sicyopterus eudentatus* from other sicydiines. *Sicyopterus eudentatus* is like other large *Sicyopterus* species, such as *S. stimpsoni* and *S. crassus* (Herre), in having median and lateral clefts in upper lip, rather than a crenulate upper lip as in *S. lividus,* and other species (see comparisons under *S. lividus*). The 11–17 caniniform teeth on the dentary is another character that distinguishes *S. eudentatus* from *S. lividus* which has just 6–7. The range of *S. eudentatus* overlaps with that of *S. stimpsoni,* a possible close relative, in which a high total of 13 caniniform dentary teeth have been observed.

Distribution.—Known from Nanpil-Kiepw River, Ponape (Fig. 1).

Etymology.—*eudentatus,* from the Greek *eu* meaning well or good, and the Latin adjective *dentatus,* meaning toothed, in reference to the high number (120) of tricuspid teeth on each premaxilla.

Material examined.—17 specimens, 50.0–101.5 mm SL, including holotype; Nanpil-Kiepw R. Holotype: CAS 67387, male, 92.5 mm SL, coll. J. A. Maciolek and J. Ford, Apr. 1982, fourth trib. of Nanpil R., Ponape (Fig. 1).

Paratypes, same data as holotype: CAS 67385 (1, 78.5 mm SL); CAS 67386 (1, 50.0 mm SL); USNM 322473 (male, 101.5 mm SL, ex. CAS 67388); BPBM 35018 (1, 77.5 mm SL, ex. CAS 67389); CAS 67390 (1, 80.0 mm SL); CAS 67391 (female, 86.0 mm SL); CAS 67392 (female, 75.0 mm SL); CAS 67393 (1, 85.5 mm SL): CAS 67394 (female, 77.5 mm SL); CAS 67395 (4, 72.0–85.0 mm SL, including male, 79.0 mm SL, female 81.0 mm SL, cleared and counterstained), ROM 64671 (1, ex. CAS 67395); CAS 67396 (1, 78.5 mm SL, cleared and stained solely with alizarin); CAS 67397 (1, 91.0 mm SL, cleared and stained solely with alizarin).

Stiphodon Weber, 1895

Stiphodon Weber, 1895: 269 [type species *Stiphodon semoni* Weber 1895: 270 by monotypy].

Stiphodon caeruleus new species
Figures 5C, 13, 14

Stiphodon sp. 1.—Maciolek and Ford, 1987: 628–629, table 2, Nanpil-Kiepw River, Ponape.

Diagnosis.—Distinguished from all other *Stiphodon* by males being brilliant cobalt blue dorsally and laterally in life.

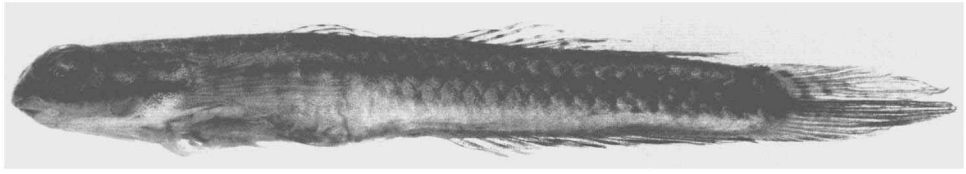

Figure 13. *Stiphodon caeruleus*, n. sp. Holotype, CAS 67350, male, 21.5 mm SL, Nanpil-Kiepw River, Ponape (Pohnpei), E. Caroline Is.

Description.—First dorsal fin VI, depressed third, fourth and fifth spines extend posteriorly beyond second dorsal-fin insertion; second dorsal fin I,9; anal fin I,10; pectoral fin 13–14 [14]; pelvic fin I,5, interspinal membrane or frenum thick; branched caudal-fin rays 13; vertebrae 10 + 16 = 26; no rakers on ventral portion of first gill arch.

Lateral scales in 21–28 [21] regular rows; few to no scales on dorsal surface of head and ventrum from tip of lower jaw to anal-fin base, larger specimens more completely scaled; body to caudal peduncle and anterior portion of caudal-fin rays covered with imbricate ctenoid scales. Two preopercular-canal pores (M′ and O′). Oculoscapular-canal pore pattern A′, B, C, D (single), F, H′, K′ and L′.

Mouth subterminal; lips thin and entire, except for small, medial cleft in upper lip; simple anterior naris about halfway between anterior margin of eye and posterior extent of upper lip; simple posterior naris anterior to eye. Premaxillary teeth tricuspid; dentary teeth caniniform; dentary with complete row of unicuspid horizontal teeth.

Head blunt and rounded in profile, head length 21–24 [23]; snout length 8–9 [8]; eye diameter 5–7 [7]; pelvic-fin length 14–16 [15]; pectoral-fin length 22–25 [23]; pre-anal length 57–61 [58]; pre-dorsal length 35–39 [36].

Preserved Color.—Dorsal fins and middle and dorsal portion of caudal-fin rays with scattered brown to black spots, middle three or four caudal-fin rays brown. Lower third of caudal fin dusky with thin dark brown ventral marginal stripe. Anal, pectoral, and pelvic fins dusky. Head and body dorsolaterally dark brown, ventral portion of body dusky pale cream (Fig. 13). Females as males except spots on middle and dorsal portion of caudal fin arranged in four or five irregular bars. Two irregular lateral stripes on head and body, dorsal stripe from snout to eye, continuing posterior to eye along head and body to caudal peduncle, ventral stripe from posterior margin of premaxilla along head through middle of pectoral fin base, becoming deeper along body to caudal peduncle. From about midbody to caudal peduncle, ventral stripe is darkest on margins of scales, paler in center of scale (Fig. 14).

Live Color.—Males bright cobalt blue dorsally and laterally, paler yellowish blue ventrally. Females with pattern as described for preserved color, except background pale yellowish cream, stripes and scattered chromatophores dark brown to black.

Comparisons.—*Stiphodon caeruleus* is like *S. semoni* from Indonesia, the Philippines, and New Guinea in having reduced squamation on dorsal surface of head and ventrum from tip of lower jaw to anal-fin base. *Stiphodon semoni* males have a bright green lateral stripe in life, whereas live male *S. caeruleus* are bright cobalt blue dorsally and laterally.

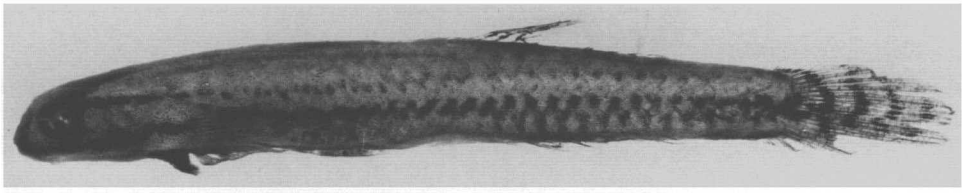

Figure 14. *Stiphodon caeruleus*, n. sp. Paratype, CAS 67354, female, 21.5 mm SL, Nanpil-Kiepw River, Ponape (Pohnpei), E. Caroline Is.

Distribution.—Known from Ninduwi, Soundah, and Nanpil-Kiepw-Meitik drainages, Ponape (Fig. 1).

Etymology.—The Latin adjective *caeruleus* meaning a deep, clear blue, in reference to bright cobalt blue color dorsally and laterally of males in life.

Material Examined.—350 specimens, 14.0–39.0 mm SL, including holotype; Ninduwi, Soundah, and Nanpil-Kiepw-Meitik drainages. Nontype material, below, is faded or poorly preserved and therefore, not given type status. Holotype: CAS 67350, male, 21.5 mm SL, coll. J. A. Maciolek and J. Ford, 12 Apr. 1982, fourth trib. of Nanpil-Kiepw R., Ponape (Fig. 1).

Paratypes, same data as holotype: CAS 67327 (31, 17.0–25.0 mm SL); Nanpil-Kiepw R., coll. J. A. Maciolek, 8 Apr. 1982, CAS 67351 (male, 24.0 mm SL), CAS 67352 (female, 25.0 mm SL), CAS 67353 (female, 20.0 mm SL), CAS 67355 (male, 21.5 mm SL), CAS 67356 (male, 21.0 mm SL), CAS 67357 (female, 20.0 mm SL), CAS 77368 (ex. CAS 67491, female, 19.0 mm SL); at dam, CAS 67354 (female, 21.5 mm SL); transect below old dam, CAS 67316 (74, 14.0–26.0 mm SL, including 2 males and 2 females cleared and counterstained, 21.0–24.5 mm SL), BPBM 35017 (8, ex. CAS 67316), USNM 322471 (8, ex. CAS 67316), ROM 64672 (4, ex. CAS 67316), CAS 67330 (21, 21.5–31.0 mm SL); coll. 9 Apr. 1982, CAS 67331 (19, 19.5–27.5 mm SL); Nanpil-Kiepw R., freshwater pool, coll. J. Ford, Apr. 1982, CAS 67321 (20, 19.0–26.0 mm SL), freshwater riffle, CAS 67333 (24: 18 males, 6 females, 18.5–26.5 mm SL); CAS 67328 (15: 4 males, 11 females, 26.0–35.5 mm SL), CAS 67336 (4: 2 males, 2 females, 30.0–36.0 mm SL). Nanpil-Kiepw R., at road's end, coll. J. A. Maciolek, 3 Aug. 1971, CAS 67318 (32 females, 17.5–31.0 mm SL), CAS 67320 (5 males, 18.0–28.0 mm SL). Nanpil-Kiepw R., coll. J. A. Maciolek, 1982, CAS 67332 (3 males, 34.5–36.5 mm SL), CAS 67344 (female, 31.5 mm SL), CAS 67345 (male, 29.0 mm SL), CAS 67346 (male, 27.5 mm SL), CAS 67347 (female, 33.0 mm SL), CAS 67348 (male, 32.0 mm SL), CAS 67349 (female, 39.0 mm SL); Meitik R., coll. V. G. Springer et al., 18 Sep. 1980, USNM 223007 (28: 17.5–25.0 mm SL). "Tomwara" or Ninduwi str., just S of Dolen Pwakorokot, 55 m elev., coll. J. A. Maciolek and J. Ford, 6 July 1986, CAS 67443 (16, 19.0–26.5 mm SL); Soundah str., E. trib. at road crossing, 70 m elev., coll. J. A. Maciolek and J. Ford, 5 July 1986, CAS 67449 (10, 21.0–30.0 mm SL).

Nontype Material.—Nanpil-Kiepw R., coll. J. A. Maciolek, 3 Aug. 1971, CAS 67317 (4, 21.0–26.0 mm SL), CAS 67329 (5, 18.0–22.5 mm SL); Ponape (no data), CAS 67358 (2 cleared and stained solely with alizarin); CAS 67466 (2 cleared and stained solely with alizarin).

Stiphodon cf. *elegans*
Figures 15, 16

Stiphodon sp. 2.—Maciolek and Ford, 1987: 628, 631, table 2, Nanpil-Kiepw River, Ponape.

Remarks and Comparisons.—This *Stiphodon* material differs from that of *S. caeruleus* in having the ventrum fully-scaled from pelvic disc to anal opening and males often with bluish-green lateral stripe rather than with brilliant cobalt blue dorsal and lateral surfaces in life. In preservative, males are much darker overall (Fig. 15) than are *S. caeruleus* males. Females (Fig. 16) have a color pattern like that of *S. caeruleus* females (Fig. 14). We tentatively refer this material to *Stiphodon elegans* (Steindachner) pending revision of the genus.

Material Examined.—18 specimens, 13.0–44.5 mm SL; Nanpil-Kiepw, Pilen Salapwuk, and Nanqui drainages. Nanpil-Kiepw R., coll. J. A. Maciolek, 1982, CAS 67319 (female, 42.0 mm SL), CAS 67322

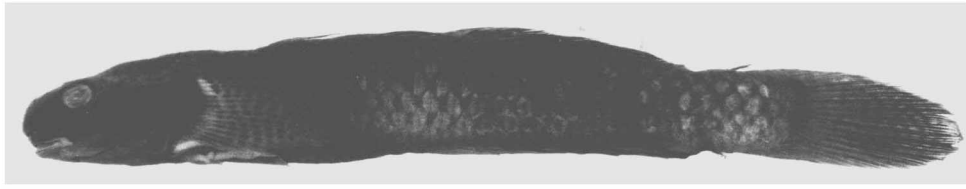

Figure 15. *Stiphodon* cf. *elegans,* CAS 67334, male, 44.5 mm SL, Nanpil-Kiepw River, Ponape (Pohnpei), E. Caroline Is.

(female, 36.5 mm SL), CAS 67323 (female, 43.5 mm SL), CAS 67324 (female, 43.0 mm SL), CAS 67325 (male, 43.0 mm SL), CAS 67326 (male, 33.5 mm SL), CAS 67334 (male, 44.5 mm SL), CAS 67335 (female, 43.5 mm SL), CAS 67465 (male, 43.0 mm SL, female, 44.5 mm SL, cleared and stained solely with alizarin); Pilen Salapwuk R., lower fork, trib. to Lehn Mesi R., 200 m elev., coll. J. A. Maciolek and J. Ford, 11 July 1986, CAS 67442 (female, 28.5 mm SL); Nanqui (Nankewi) R. downstream from Jokaj waterfall, coll. V. G. Springer et al., 5 Sep. 1980, USNM 223256 (7: juveniles and females, 13.0–25.0 mm SL).

Key to Sicydiine Gobies of Ponape

Some characters follow Sakai and Nakamura (1979: 49).

1a. Median and pectoral-fin rays blackened; mouth terminal, premaxillary teeth unicuspid, no fleshy sac with replacement teeth; dentary teeth unicuspid, no horizontal teeth; scales cycloid ..... *Sicyopus nigriradiatus* new species

1b. Median and pectoral-fin rays clear or with scattered, dusky chromatophores; mouth subterminal, premaxillary teeth bi- or tricuspid; dentary with internal row of caniniform teeth and external row of horizontal teeth; fleshy sac with replacement teeth just above upper jaw; scales cycloid and ctenoid 2

2a. Predorsal scales absent; two preopercular-canal pores (M′ and O′); oculoscapular-canal pore pattern A′, B, C, D (single), F, H′, K′ and L′; premaxilla with narrow, elongate ascending/articular process (Fig. 5C) ..... *Stiphodon* 3

2b. Body completely scaled; three preopercular-canal pores (M′, N, and O′); oculoscapular-canal pore pattern A′, B, C, D (single), F, HK and L′; premaxilla with short, blunt ascending/articular process (Fig. 5D) ..... *Sicyopterus* 4

3a. Head and ventrum from tip of lower jaw to anal-fin base with few or no scales in adults and juveniles, males brilliant cobalt blue dorsally and laterally in life; adults to 39 mm SL, but usually less than 30 mm SL ..... *Stiphodon caeruleus* new species

3b. Body posterior to head completely scaled in adults, head and ventrum from tip of lower jaw to anal-fin base with few or no scales in juveniles, males with bluish-green lateral stripe in life; adults to 44.5 mm SL, usually more than 30 mm SL ..... *Stiphodon* cf. *elegans*

4a. Upper lip crenulate (Fig. 12A); fleshy papillae on underside of upper lip minute or absent; premaxillary teeth bicuspid, of moderate width (approximately 60 teeth on each premaxilla, Fig. 11A); 6–7 caniniform teeth on dentary; snout length 9–11; males in life with cobalt blue background coloration, five to six black saddle bars, and caudal fin orange; adults to 60 mm SL ..... *Sicyopterus lividus* new species

4b. Upper lip with a median cleft and a lateral cleft, slightly crenulate posteriorly (Fig. 12B); large, fleshy papillae on underside of upper lip; premaxillary teeth tricuspid, thin, closely

Figure 16. *Stiphodon* cf. *elegans,* CAS 67335, female, 43.5 mm SL, Nanpil-Kiepw River, Ponape (Pohnpei), E. Caroline Is.

packed (approximately 120 teeth on each premaxilla, Fig. 11B); 11–17 caniniform teeth on dentary; snout length 5–6; males and females in life and in preservative nearly dark brown to black on dorsum, ventral surface paler; adults to 101.5 mm SL ..... *Sicyopterus eudentatus* new species

Acknowledgments

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E. C. Thornton collaborated with specimen identification and distribution, and D. Catania, J. Fong, and P. Sonoda contributed technical assistance at CAS. Skippy Hau donated specimens of Hawaiian sicydiines to the USNM. M. Tenorio (CAS) took the scanning electron micrographs. Theophilus Britt Griswold photographed the holotypes and paratypes. J. Howe (USNM) prepared radiographs and mounted photographs.

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